

Prognosticating in patients with advanced cancer—observational study comparing the accuracy of clinicians' and patients' estimates of survival

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Received 31 January 2012; revised 30 March & 13 June 2012; accepted 18 July 2012

Background: Clinicians' prognoses in patients with advanced cancer are imprecise. The aim of this study was to compare doctors', nurses' and patients' survival predictions and to identify factors which influence accuracy.

Patients and methods: Some 1018 patients with advanced cancer were recruited. Survival estimates were obtained from the attending doctor, nurse, multidisciplinary team (MDT) and patient ($n = 829, 954, 987$ and 290 estimates, respectively) and were compared with actual survival. Clinician and patient characteristics were recorded.

Results: MDTs', doctors' and nurses' predictions were accurate 57.5%, 56.3% and 55.5% of occasions, respectively. Nurses were less accurate than the MDT ($P = 0.007$) but were no worse than doctors ($P = 0.284$). Estimates of clinicians and patients were more optimistic (doctors: 31%; nurses: 34%; MDT: 31.1%; patients: 45.1%) than pessimistic (12.7%, 11%, 11.4% and 2.7%). Nurses' accuracy increased if they had reviewed the patient within 24 h. Most patients (61.4%) wanted to know their prognosis. Only 37.1% were willing to offer an estimate regarding their own survival. Patients' prognostic estimates were less accurate than health care professionals' ($P < 0.001$).

Conclusions: MDTs were better at predicting survival than doctors' or nurses' alone. Patients were substantially worse. Among nurses, recency of review was related to improved prognostic accuracy.

Key words: neoplasm, palliative care, prognosis, terminal care

Introduction

Patients with advanced cancer value prognostic information because they consider issues of 'preparation' to be important [1]. Accurate prognostic information allows patients to clarify their choices over future management of their illness [2]. Physicians are less likely than patients to agree with the importance of the knowledge of timing of one's own death [1] and are often reluctant to give prognostic estimates [3].

In practice, the most frequently employed method of prognosticating is the clinician prediction of survival (CPS). This relies on clinicians' experience and is subject to cognitive bias. Previous studies have concluded that such estimates are systematically inaccurate and overoptimistic [4–7]. Some studies report a 'horizon effect' where CPS is more accurate closer to death [6, 8, 9] while other studies challenge this [10–12]. There is some evidence that CPS may be more accurate with repeated evaluations [7, 10, 13]. A number of

questions about which clinician-related factors influence the accuracy of estimates remain unanswered. There is inconsistent evidence that any particular discipline (i.e. doctors, nurses or nursing auxiliaries) [13–16] or that different medical specialities (e.g. oncologists, palliative care physicians and general practitioners) [11, 12, 17–19] are more accurate prognosticators. Studies examining the influence of clinical experience on accuracy are also inconclusive [16, 19, 20]. One study [19] suggests that the weaker the doctor–patient relationship, the more accurate a CPS would be.

Anecdotally, it is sometimes reported that patients might have better insight into their own mortality than health care professionals. Only one previous study, to our knowledge, has examined the accuracy of cancer patients' own survival estimates [21]. As part of the SUPPORT study, patients with metastatic cancer were asked, 'What are the chances that you will live for two months or more if the current plan of care stays the same?' Relatively few patients responded to the question but those who did were found to be even more overoptimistic than clinicians.

The Prognosis in Palliative care Study (PiPS) was a prospective observational study of patients with advanced

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cancer no longer undergoing active treatment [22]. The purpose of the study was to develop a prognostic scoring system that was at least as accurate as clinician estimates of survival. As part of the study, doctors, nurses and patients themselves were asked to make prognostic estimates. This article reports on the accuracy of these estimates and the factors that affect the prognostic accuracy of clinicians.

methods

study settings

This was a multicenter study involving 18 palliative care services across England.

patient population

Patients (both competent and incompetent) with advanced, incurable cancer, newly referred to the relevant palliative care service were recruited.

clinician prediction of survival

Clinician estimates were obtained from the doctor and/or nurse who attended the patient on the day of study entry. Sometimes, this was also the clinician with overall responsibility for the patient's care, but on other occasions, it was a more junior member of staff. Clinicians were asked to predict the survival of the patient using a categorical scale of 'days' (<14 days), 'weeks' (2 weeks to less than 8 weeks), 'months' (2 months to less than 12 months) and 'years' (≥ 12 months). These categories were chosen as they had most face validity among palliative care practitioners. Clinicians seldom make precise predictions and requiring clinicians to predict survival to the nearest day or week would have resulted in spuriously accurate prognostic predictions.

Researchers obtained a clinician estimate of survival independently from both a doctor and a nurse on the day of study entry. These estimates were obtained without conferring between clinicians. When the estimates agreed then this was also taken to represent the 'combined multi-professional estimate'. When there was a discrepancy between the doctor and the nurse, they were asked to discuss the case and arrive at an agreed estimate. When no such discussion/agreement took place, the doctor's prediction was used; when no doctor's estimate was available, the nurse's estimate was used. The purpose of obtaining a combined MDT estimate was to mirror day-to-day clinical practice and to provide the most demanding benchmark against which to judge the accuracy of the PiPS.

Clinicians were asked to provide data about themselves; gender, age, grade or professional level, number of years since qualification, number of years of palliative care experience, the length of time they had known the patient and the time elapsed since they had last seen the patient.

patient predictions of survival

Patients were asked to respond to two questions:

- 1) 'Doctors are not very good at predicting how long patients with cancer are likely to survive. Despite this, some people with cancer are keen to know how long doctors think that they are going to live. Other people would rather not know. Which of the statements below best represents the way that you feel about this question:
 - a) I would rather not know at all how long the doctors expect that I am going to live.
 - b) I would only like to know approximately (to the nearest few months or years) how long the doctors expect that I am going to live.
 - c) If it were possible, I would like to know exactly (to the nearest few weeks) how long the doctors expect that I am going to live.
 - d) I don't know (or don't care) about this issue.

- 2) Some people have a feeling about how long they have left to live. If you have a feeling about this question, please tick the box that best represents the way that you feel. If you do not wish to answer this question, then please indicate this by ticking the last box.
 - a) I feel that I am likely to live for 'Days' (<14 days).
 - b) I feel that I am likely to live for 'Weeks' (between 2 weeks and 7 weeks).
 - c) I feel that I am likely to live for 'Months' (between 2 months and 11 months).
 - d) I feel that I am likely to live for 'Years' (1 year or more).
 - e) I don't know.
 - f) I don't want to answer this question.

Patients were also invited to write any free-text comments.

ethical approval

This study was approved by the Wandsworth Multi-Centre Research Ethics Committee.

procedures

Eligible competent patients were identified and (with the agreement of the clinical team) were provided with information and invited to participate in the study. The relatives or carers of eligible incompetent patients were asked for assent. Participants were flagged with the National Health Service Information Centre so that the study team were notified when they died. Survival was calculated (in days) from the date of study entry.

statistical methods

The accuracy of clinical predictions was determined by examining the agreement between CPS categories and actual survival (AS). The extent of agreement between CPS and AS was quantified by use of the linear weighted Kappa (LWK) statistic. Kappa coefficients were also used to compare predicted and AS by characteristic of the doctor, nurse, multidisciplinary team (MDT) or patient. A bootstrap method was employed for pairwise comparison of Kappa coefficients. Because very few patients were predicted (or actually) survived for 'years', this category was collapsed into the 'months' category to produce a new grouping ('months+'). Wilcoxon Matched Pairs Exact test was used to test whether the doctors', nurses' or patients' estimates were more optimistic than the AS.

results

In total 1018 patients were recruited. The mean survival of the sample was 89 days, with 281 (28%) patients surviving for 'days', 337 (33%) surviving for 'weeks' and 400 (39%) surviving for 'months or more'. A doctor's survival estimate was available for 829 patients from 136 different doctors. A nurse's estimate was available for 954 patients from 280 different nurses. A combined multiprofessional prognostic estimate was available for 987 (97%) patients. Only 290 patients (28%) shared their own survival estimates with the research team.

The accuracy of doctors', nurses' and MDT estimates are shown in Table 1. By chance alone, one would expect the prognostic estimates to be correct on ~33% of occasions. In fact, all groups performed better than this, with the MDT estimates being most frequently accurate (57.5% of occasions) and the patients' predictions being the least accurate (52.1%). Patients' predictions were significantly ($P < 0.001$) less accurate than any of the clinical groups. Nurses were less accurate than

Table 1. Accuracy of prognostic predictions

| | Actual survival Count of patients (% of total) | | | | Absolute agreement between prediction and survival | Linear-weighted Kappa ^a (LWK) | Versus Doctor, <i>P</i> ^b | Versus Nurse, <i>P</i> ^b | Versus MDT, <i>P</i> ^b | Versus Patient, <i>P</i> ^b |
|-------------------------|--|------------|------------|-------------|--|--|--------------------------------------|-------------------------------------|-----------------------------------|---------------------------------------|
| | Days | Weeks | Months+ | Total | | | | | | |
| Doctors' prediction | | | | | | | | | | |
| Days | 137 (16.5) | 16 (1.9) | 3 (0.4) | 156 (18.8) | 56.3% | 0.442 | | 0.154 | 0.284 | <0.001 |
| Weeks | 82 (9.9) | 126 (15.2) | 86 (10.4) | 294 (35.5) | | | | | | |
| Months+ | 36 (4.3) | 139 (16.8) | 204 (24.6) | 379 (45.7) | | | | | | |
| Total | 255 (30.8) | 281 (33.9) | 293 (35.3) | 829 (100.0) | | | | | | |
| Nurses' prediction | | | | | | | | | | |
| Days | 135 (14.2) | 19 (2.0) | 7 (0.7) | 161 (16.9) | 55.2% | 0.412 | | | 0.007 | <0.001 |
| Weeks | 84 (8.8) | 116 (12.2) | 79 (8.3) | 279 (29.2) | | | | | | |
| Months+ | 52 (5.5) | 186 (19.5) | 276 (28.9) | 514 (53.9) | | | | | | |
| Total | 271 (28.4) | 321 (33.6) | 362 (37.9) | 954 (100.0) | | | | | | |
| Combined MDT prediction | | | | | | | | | | |
| Days | 147 (14.9) | 17 (1.7) | 4 (0.4) | 168 (17.0) | 57.5% | 0.457 | | | | <0.001 |
| Weeks | 96 (9.7) | 136 (13.8) | 92 (9.3) | 324 (32.8) | | | | | | |
| Months+ | 35 (3.5) | 176 (17.8) | 284 (28.8) | 495 (50.2) | | | | | | |
| Total | 278 (28.2) | 329 (33.3) | 380 (38.5) | 987 (100.0) | | | | | | |
| Patients' prediction | | | | | | | | | | |
| Days | 2 (0.7) | 1 (0.3) | 2 (0.7) | 5 (1.7) | 52.1% | 0.144 | | | | |
| Weeks | 15 (5.2) | 17 (5.9) | 5 (1.7) | 37 (12.8) | | | | | | |
| Months+ | 30 (10.3) | 86 (29.7) | 132 (45.5) | 248 (85.5) | | | | | | |
| Total | 47 (16.2) | 104 (35.9) | 139 (47.9) | 290 (100.0) | | | | | | |

^aLWK refers to the degree of agreement between the prognosticator's estimate and actual survival.

^b*P* value for comparison between LWK for different prognosticators.

a combined MDT estimate but were not significantly worse than a doctor alone.

Survival estimates of clinicians were significantly ($P < 0.001$) more likely to be optimistic (doctors: 31%; nurses: 34%; MDT: 31.1%) than pessimistic (12.7%, 11% and 11.4%, respectively). Patients' predictions were much more optimistic than clinicians' (45.1% optimistic, 2.7% pessimistic).

factors affecting the accuracy of clinician predictions

Table 2 shows the characteristics of the clinicians. A larger proportion of the doctors than the nurses who provided prognostic estimates were male (47/136; 34.6% versus 20/281; 7.1%). The mean age of the doctors was 33.1 years and of the nurses was 42.5 years. Reflecting their greater age, the nurses had been qualified for longer and had more experience in palliative care than the doctors.

Accuracy of prediction was not affected by the gender, age, grade, years of professional or speciality experience of the prognosticator or the length of time that the clinician had known the patient (Table 3). Estimates undertaken by nurses who had last assessed the patient less than 1 day previously were more accurate (LWK = 0.428) than estimates undertaken by nurses who had not seen the patient for over 24 h ($P < 0.01$).

patients' estimates of survival

Overall 778/1018 (76%) competent patients were asked to describe their prognostic preferences. The majority of patients (478/778, 61%) indicated that, if the information was available, they would want to know their prognosis, 176 (23%) would prefer not to know and 124 (16%) were ambivalent (did 'not know' or 'not care' about the issue). Of those who indicated that they would like to be given an estimate of survival, 250/478 (52%) indicated that they would like to know exactly (to the nearest few weeks) and 228/478 (48%) indicated that they

would like to know approximately (to the nearest few months or years).

Of those patients able to describe their prognostic preferences, only 290/778 (37%) had any intuition about how long they expected to live and were able to offer a subjective prognostic estimate. Of the patients who did not offer an estimate, the majority (353/488, 72%) simply 'didn't know' what their prognosis was. The remainder did not want to answer (126/489, 25.7%) or did not respond to the question (10/489, 2%).

discussion

statement of principal findings

Clinicians and patients could accurately predict whether patients would survive for 'days', 'weeks' or 'months+' between 51.1% and 57.5% of occasions. Clinicians' predictions were more likely to be optimistic (31.1%) than pessimistic (11.4%). Patients were optimistic about their own survival on 45.1% of occasions and pessimistic on only 2.7% of occasions. Nurses' predictions of survival were significantly less accurate than the MDT prediction but were not significantly worse than doctors' predictions. Prognostic accuracy of nurses improved when the time lapse since last seeing the patient was <24 h.

strengths and weaknesses

This was a large, multicenter, prospective study. Clinician prognostic estimates were available for the majority (97%) of participants, and no patients were lost to follow-up. More information about the clinicians (e.g. length of postgraduate training) or their degree of familiarity with the patients (e.g. number of previous assessments) may have been helpful in understanding the factors that affected predictive accuracy. The manner in which prognostic estimates were obtained from clinicians closely mirrored clinical practice. Most clinicians are comfortable with the concept of categorising patients by an expected survival of 'days', 'weeks' or 'months+'. Our findings therefore have face validity and are readily applicable to clinical practice.

As far as we are aware, this is the first study to have systematically asked patients for a temporal estimate of their own survival. We were initially apprehensive about including this question in our study, but user opinion was consistently supportive of this approach, and no patients objected to this aspect of the study. However, only 37% of patients who were able to offer a prognostic estimate about their own survival did so. It would have been useful to explore in more depth the understanding of patients about their own illness and the likely outcome. However, a questionnaire was not the most appropriate way to obtain such information and although a space was provided for 'comments' it was rarely used. A nested qualitative study to explore some of these issues might have been valuable but was beyond the resources of the current project, but clearly could be explored in future work.

relationship to other studies

We found that the majority (61%) of patients with advanced cancer wanted to know their own prognosis and this concurs with previous studies [1, 2, 23]. In general, health care

Table 2. Description of clinicians

| | Doctors | Nurses |
|--|------------------|------------------|
| N | 136 (830 events) | 280 (954 events) |
| Age (years), mean (SD) | 33.06 (7.7) | 42.5 (10.1) |
| Gender, male N (%) | 47 (34.6) | 20 (7.1) |
| Length of time qualified (years), mean (SD) | 9.22 (8.0) | 13.13 (11.1) |
| Length of time working in palliative care (years), mean (SD) | 3.53 (5.1) | 6.98 (6.8) |
| Length of time clinician had known patient | | |
| <1 week, N (%) | 101 (74.3) | 203 (72.5) |
| <1 month, N (%) | 28 (20.6) | 52 (18.6) |
| <3 months, N (%) | 5 (3.7) | 14 (5.0) |
| ≥3 months, N (%) | 2 (1.5) | 11 (3.9) |
| Time since clinician had last assessed patient | | |
| Same day, N (%) | 90 (66.2) | 229 (81.8) |
| <3 days, N (%) | 34 (25.0) | 33 (11.8) |
| <1 week, N (%) | 9 (6.6) | 12 (4.3) |
| <1 month, N (%) | 3 (2.2) | 6 (2.1) |

Table 3. Clinician related variables and accuracy of predictions

| | Nurse predictions | | | Doctor predictions | | |
|---|--------------------|----------|-----------------------|--------------------|----------|-----------------------|
| | Absolute agreement | LW Kappa | <i>P</i> ^a | Absolute agreement | LW Kappa | <i>P</i> ^a |
| Gender | | | | | | |
| Male | 0.483 | 0.324 | – | 0.545 | 0.411 | – |
| Female | 0.557 | 0.418 | 0.131 | 0.574 | 0.460 | 0.138 |
| Age (years) | | | | | | |
| ≤30 | 0.553 | 0.434 | – | 0.580 | 0.462 | – |
| 31–40 | 0.565 | 0.444 | 0.442 | 0.581 | 0.470 | 0.444 |
| 41–50 | 0.537 | 0.369 | 0.169 | 0.547 | 0.413 | 0.202 |
| ≥51 | 0.557 | 0.401 | 0.339 | NA | NA | NA |
| Grade | | | | | | |
| Unqualified | 0.552 | 0.384 | – | NA | NA | NA |
| Qualified ^b | 0.547 | 0.401 | 0.410 | 0.563 | 0.424 | – |
| Qualified and senior position ^b | 0.565 | 0.441 | 0.244 | 0.562 | 0.434 | 0.417 |
| Years of professional experience | | | | | | |
| ≤5 | 0.523 | 0.348 | – | 0.549 | 0.425 | – |
| 6–10 ^c | 0.566 | 0.442 | 0.102 | 0.564 | 0.440 | 0.388 |
| 11–15 ^c | 0.553 | 0.420 | 0.201 | NA | NA | NA |
| 16–25 ^c | 0.565 | 0.428 | 0.094 | 0.589 | 0.464 | 0.305 |
| >25.5 ^c | 0.561 | 0.438 | 0.122 | NA | NA | NA |
| Years of speciality experience | | | | | | |
| ≤5 | 0.523 | 0.376 | – | 0.549 | 0.425 | – |
| 6–15 | 0.581 | 0.452 | 0.079 | 0.564 | 0.440 | 0.395 |
| >15 | 0.585 | 0.444 | 0.168 | 0.589 | 0.464 | 0.292 |
| Length of time patient has been known to clinician | | | | | | |
| <1 week | 0.551 | 0.421 | – | 0.548 | 0.426 | – |
| <1 month | 0.511 | 0.333 | 0.075 | 0.608 | 0.506 | 0.125 |
| ≥1 month | 0.623 | 0.330 | 0.111 | 0.607 | 0.387 | 0.369 |
| Time elapsed since patient last assessed by clinician | | | | | | |
| Within 24 h | 0.556 | 0.428 | – | 0.569 | 0.452 | – |
| Within 3 days | 0.472 | 0.251 | 0.010 | 0.563 | 0.437 | 0.404 |
| Less than a week ^d | 0.603 | 0.167 | 0.001 | 0.489 | 0.268 | 0.058 |
| 1 week or more ^d | 0.04 | 0.140 | 0.005 | NA | NA | NA |

–, baseline category; NA, not applicable—this category did not apply to medical staff.

^aSignificance level associated with the change in weighted Kappa from the base category.

^bFor medical personnel ‘qualified and senior position’ refers to ‘consultants’, all other medical staff were simply categorised as ‘qualified’.

^cFor medical personnel, due to small numbers, the categories for years of professional experience were condensed into ≤5, 6 to 15 and >15 years.

^dFor medical personnel, due to small numbers, the categories for time elapsed were condensed into ‘within 24 h’, ‘within 3 days’ and ‘more than 3 days’.

professionals tend to be inaccurate in their survival predictions. Errors occur in both directions with optimistic survival estimations tending to be more common [4, 6, 7]. A systematic review [6] found that, in all but one of the studies identified, clinical predictions overestimated actual survival times. The results of our study concur with these findings. Approximately one-third of all estimates (31%–34%) were optimistic (patients survived for fewer days than was predicted) and 11%–12.6% of estimates were pessimistic (patients survived for longer than predicted).

Previous studies examining the relative accuracy of doctors’ and nurses’ survival predictions reported that there was little difference in their ability to estimate survival in patients with advanced cancer [14, 15, 17]. A similar lack of interprofessional difference in prognostic ability has been reported in the noncancer setting [24]. In contrast, one recent study [16] found that nurses and junior doctors were slightly

more accurate than consultants but that their estimates only showed ‘moderate’ agreement at best. Two previous studies comparing the accuracy of MDT estimates with uniprofessional estimates both found that the involvement of the MDT did not significantly improve prognostic predictions. In contrast, our study found that nurses estimating alone were significantly worse at predicting survival than the multiprofessional team.

Some previous studies have suggested that more experienced clinicians are better prognosticators [19, 20]. Recent studies have challenged this conclusion and have shown that increased knowledge and experience do not necessarily reduce the error in CPS [24]. We found no evidence to support the contention that greater experience results in more accurate prognostic estimates.

The ‘horizon effect’ describes the phenomenon whereby clinicians appear to be more accurate at predicting survival when patients have a shorter time to live. Studies are

conflicting about whether the 'horizon effect' truly applies to CPS. Several studies, including a systematic review which pooled and analysed 1563 clinician predictions [6], have indicated that CPS has better predictive value in the short term but is less accurate in the longer term (i.e. beyond 6 months) [6, 8, 9]. In contrast, some studies have reported the opposite effect (predictions made, when the patient is close to death, are less accurate) [10–12]. A recent study by Stiel and et al. [25] showed that clinicians were more accurate at estimating either a good or a poor prognosis than they were at estimating an intermediate prognosis. Our own study partially supports the concept of the horizon effect. Examining the frequency tables of all clinician predictions shows that the percentage of patients whom were accurately predicted to live 'days', 'weeks' and 'months+' was highest in the 'days' category for all three groups. Clinicians were next most accurate when predicting a prognosis of 'months+', but were least accurate when predicting a midterm survival of weeks. For example, the MDT prediction was correct 87.5% (147/168) of the time when predicting a survival of 'days', 42.0% (136/324) of the time when predicting a survival of 'weeks' and 57.5% (284/495) of the time when predicting a survival of 'months'. Given that prognostic assessment is frequently concerned with identifying those patients with an intermediate prognosis (in order to allow for advanced care planning and time to set up services for appropriate end of life care) further investigation of this effect would be useful.

Our data suggest that many patients who are imminently dying are unaware of (or unwilling to acknowledge) their poor prognosis [26, 27]. The overall prognostic accuracy of patients was 52.1%. However, the correct prognoses were nearly all made by patients who estimated their own survival at 'months+'. Only a very small minority of patients in the last 'days' of life accurately recognised this (2/47; 4%).

meaning of the study

Since clinician predictions are only accurate on ~55% of occasions it may appear that they would be of little clinical utility. However, the positive predictive value of clinicians' predictions is substantially higher than this. Thus, if the MDT estimates that a patient is likely to die within 2 weeks then that prediction is correct on 87.5% of occasions. This relatively high 'positive predictive value' for an MDT prognosis of 'days' means that it is not unreasonable to use MDT survival estimates as a reliable predictor of (for instance) suitability for admission to hospice for a terminal care admission. The drawback with this approach, however, is that the MDT will only identify half (147/278; 52.9%) of those patients who actually go on to die in less than 2 weeks.

unanswered questions and future research

Further research should try to identify the factors that clinicians use to formulate their predictions so that these can be incorporated into existing prognostic scoring systems and be used to educate other clinicians about how to improve their clinical skills in prognostication.

Our study has refuted the suggestion that patients' own intuition about their survival is more reliable than the

professional opinion of a doctor or a nurse. Patients' optimism may reflect the poor communication skills of clinical staff, such that prognostic information has not been adequately explained to patients, or it may represent a psychological coping response by patients to living with a life-limiting illness. Further research is required to elucidate the reasons underlying this phenomenon and whether maintaining an 'optimistic' outlook is actually beneficial to patients.

acknowledgements

PS, BG, VK, CT, CR, LK and SB contributed to the study conception and design. CR, MG and BG contributed to the analysis of data. All authors contributed to the interpretation of data, the drafting or revising of the manuscript and final approval for publication. PS acts as the guarantor for this manuscript.

The authors thank the following colleagues for their help with this study; Rehana Bakawala, Professor Mike Bennett, Teresa Beynon, Dr Cath Blinman, Dr Patricia Brayden, Helen Brunskill, Dr Kate Crossland, Dr Alison Cubbitt, Rachel Glascott, Anita Griggs, Anne Harbison, Deborah Hart, Dr Phil Lomax, Dr Caroline Lucas, Dr Wendy Makin, Dr Oliver Minton, Dr Paul Perkins, Marek Plaskota, Katie Richies, Dr Susan Salt, Ileana Samanidis, Dr Margaret Saunders, Dr Jennifer Todd, Dr Catherine Waight, Dr Nicola Wilderspin, Dr Gail Wiley and Julie Young

The authors also thank Professor John Ellershaw for chairing the steering committee and Robert Godsill for providing a service user perspective. The authors also thanks Rosie Head for administrative support and data management.

The authors also thank the following hospices and palliative care units for their participation in the study; St John's Hospice (Lancaster), Gloucestershire Hospitals NHS Foundation Trust, The Pasque Hospice (Luton), Guy's and St Thomas' NHS Foundation Trust, Princess Alice Hospice (Esher), Bolton Hospice, St Catherine's Hospice (Crawley), St George's Hospital NHS Trust, Surrey and Sussex Healthcare NHS Trust, St Ann's Hospice Manchester, Christie Hospital Manchester, Nightingale Macmillan Unit (Derby), Trinity Hospice (London) and Trinity Hospice (Blackpool).

funding

This study was funded by Cancer Research UK. Grant number C11075/A6126. SB is funded by Macmillan Cancer Support and the NIHR CLAHRC (Collaborations for Leadership in Applied Health Research and Care) for Cambridgeshire and Peterborough. Recruitment in Manchester (CT) was supported by Flexibility and Sustainability funding from the National Cancer Research Network.

disclosure

The authors have declared no conflicts of interest.

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